

Colorado School of Mines Research Institute

May 29, 1984

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CSMRI

CSMRI Project NP841074

Mr. T. R. Grey
President
Lee Mining Corporation
P.O. Box 1928
Evergreen, Colorado 80439

Dear Mr. Grey:

The purpose of this letter is to clarify the concepts involved with handling and treatment of waste resulting from cyanide leaching of the North Lily tailings. This letter will specifically address the concept proposed by Lee Mining Corporation of chemically treating leached residue as a final part of a horizontal vacuum-belt filter process step. Laboratory studies simulating this type of process step were conducted by CSMRI, with the results showing the concept to be a viable method for cyanide "destruction" and tailings detoxification. The various aspects of this type of waste treatment are discussed as follows.

BACKGROUND

It has been common practice in gold leaching operations to retain all plant waste in sealed ponds. Typically, the solids are allowed to settle to the bottom of the ponds, and the liquid recycled in part back to the plant. Excess liquid is typically oxidized chemically and discharged to adjacent natural drainage paths. Until recently, almost all operations utilized either sodium or calcium hypochlorite for this oxidation step because of a cost advantage over reagents such as H_2O_2 , ozone, or $KMnO_4$. Several species of metal cyanides are usually present in the water, including those of most of the base metals and of iron cyanides. The effect of the hypochlorite treatment is to oxidize the free cyanide, to oxidize the cyanide complexed with the base metals to cyanate and to oxidize the iron to the ferric valence. Cyanate as well as cyanide complexed with ferric iron have been present in discharge streams over many years and have not been proven a notable environmental problem. It should be pointed out quite strongly that iron cyanide species, even though analyzable in part by the acidified distillation procedure (ASTM 1976), are considered to be essentially inert in the presence of natural groundwater or surface runoff.

PROPOSED LEE MINING PROCEDURE

The method of waste handling and treatment proposed by the Lee Mining Corporation would incorporate the use of a horizontal vacuum belt filter for dewatering and washing the leached tailings. The novel or unusual part of this proposed procedure consists of utilizing a final stage on the belt

for the introduction of hypochlorite solution. The hypochlorite solution would thus contact any remaining soluble cyanides as well as the insoluble and poorly soluble cyanides remaining with the solids. With the destruction of all hypochlorite oxidizable cyanide species, Lee Mining has proposed to handle these treated solids without impoundment.

There are existing cyanide leaching operations which treat the sealed pond discharge water with hypochlorite and produce an acceptable discharge. The Lee concept is to have treated the total tailing with hypochlorite such that any water leaching which might take place would result in a water similar to that discharging from existing ponds.

DISCUSSION OF BENCH-SCALE TESTING

The procedure used at a CSMRI in simulating this novel approach to tailings detoxification was far more severe than has been practical in other operations and is felt to produce as high a degree of cyanide destruction as can be obtained with hypochlorite. In this regard, the following aspects of this procedure are pointed out.

1. The use of a relatively strong hypochlorite solution ensures a maximum response with reactable cyanides. The fact that the tailings are not further washed will provide an appreciable excess of unreacted hypochlorite to enter the "curing" period.
2. The conventional cyanide oxidation time requirement of 1 hr is more than met by any subsequent tailings handling methods which might be used.
3. Analysis of the test fractions as listed in CSMRI's April 11, 1984 letter report (Tests 1 and 2) define the water leachable chlorinatable cyanides as nil. The limit of detection in these particular analysis was 2 ppm as NaCN.
4. The data entries in this report defined as "water soluble non-chlorinatable cyanide" must be accepted as essentially species of ferric cyanide. The general environmental acceptability of these compounds was discussed earlier.
5. The behavior of these inert cyanide species in regards to adsorption by the soil or downward percolation cannot be defined on the basis of this study.

Mr. T. R. Grey

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Please let me know if you have any questions or further requirements regarding cyanide detoxification of the North Lily tailings.

Very truly yours,

A handwritten signature in cursive script, appearing to read "Hal D. Peterson".

Hal D. Peterson
Technical Consultant
Process Division

/rms

EXHIBIT # 7
AS THEY EXIST NOW

TABLE B-3 - TAILINGS SURFACE COATING ANALYSIS
(RD 80-175-12)

Chemical Analysis

Au	0.029	oz/ton
Ag	2.65	oz/ton
Pb	1.92%	
Zn	0.44%	
Fe	8.2 %	
C	0.2 %	
CaO	3.8 %	

Emission Specifications

<u>Element</u>	<u>Estimated Percent</u>
Al	>1.0
Sb	0.1
As	0.2 = 200 mg/L
Ba	1.0
Be	0.0001
Bi	0.01
B	0.001
Cd	0.002
Cr	0.002
Co	0.001
Cu	0.2
Ga	0.002
Ge	<0.001
In	<0.001
Mg	0.1
Mn	0.2
Mo	0.002
Ni	0.002
Si	>1.0
Sn	0.002
Na	1.0
Ti	0.05
W	<0.01
V	0.004

EXHIBIT #7
AS THEY EXIST NOW

TABLE B-2 - COMPOSITE TAILINGS GRAB SAMPLE ASSAYS
(SAMPLE 79-211, 1-4)

<u>Element</u>	<u>Percent</u>
As	0.4
Ba	>1.0
Be	<0.0001
Bi	0.02
B	0.002
Cd	0.001
Cr	0.001
Co	<0.001
Ga	0.004
Ge	<0.001
In	<0.001
Mn	0.4
Mo	0.001
Sn	0.008
Na	0.8
Ti	0.05
W	<0.01
V	0.001